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[Reports to the Surgeon-General United States Marine-Hospital Service.]

An improved formaldehyd lamp.

HYGIENIC LABORATORY,
Washington, D. C., August 14, 1900.

SIR: I have the honor to submit the following preliminary report of the formaldehyd generator known as the Kuhn Formaldehyd Generator which you desired I should test, as to efficiency, in this laboratory.

I would beg to state for your information that the Kuhn generator is an apparatus designed to produce formaldehyd gas by the dehydrogenization of wood or methyl alcohol. This object is accomplished by passing the vapor of wood alcohol through disks or plates which contain incandescent metallic platinum in a state of fine division.

The principle involved is the same as that described by Surg. J. J. Kinyoun, of the Marine-Hospital Service, in the PUBLIC HEALTH REPORTS of January 29, 1897, the mechanical design being, however, an improvement on that described and shown by Dr. Kinyoun.

The generator accomplishes this end in a way superior to any formaldehyd generators which have heretofore come under my observation by having the disks of asbestos, 2 in number, perforated with a large number of quite small holes. The lower of these 2 asbestos disks is shaped in the form of a cone, its apex directed upwards, and is platinized on its upper surface, thus causing this disk in addition to its chemical action, to act as a deflector, preventing the heat being thrown down upon the surface of the vessel containing the wood alcohol and thus preventing too rapid combustion and explosion. In addition, the cylinder carrying these asbestos disks is further furnished with five wire-gauze diaphrams which are platinized by a process constituting one of the features of the Kuhn patent. The wire disks are contained in a Russia iron cone-shaped chimney, which is placed within the body of the generator, and which is designed not only to carry and protect the disks but to increase the draft, furnish the oxygen for combustion, keep the temperature uniform, and thus prevent the formation of paraformaldehyd, from which defect this generator is entirely free.

It will thus be seen that the vapor of alcohol, instead of being subjected to the action of 1 platinized disk, as in other lamps, is obliged to pass through 7 heated platinized surfaces, 2 of which, the asbestos ones, are in a state of incandescence. This fact disposes of the difficulty experienced in formaldehyd lamps heretofore constructed of permitting the escape of the vapor of alcohol at the top of the generator. This has been a source of danger and of unequal, unreliable performance in the lamps heretofore exploited, as before, the alcohol was liable to reignition and combustion and might cause serious conflagration and in addition, a large proportion of the alcohol volatilized escaped dehydrogenization, and therefore, was not converted into formaldehyd.

Experiments have been made in the laboratory looking to this point. It has been found absolutely impossible to obtain any ignition of alcohol from the top of the generator when its operation had once commenced. The Kuhn generator, in addition, presents the important feature of having the lower end of the cylinder containing the disks of asbestos and wire submerged in water while in operation. This not only acts as a water seal and prevents explosion, but, in addition, a certain amount of water is vaporized during the combustion of the alcohol, and this watery vapor essentially increases the germicidal power of the formaldehyd evolved. This is in direct corroboration of the experiments of

Dr. Rosenau, the director of this laboratory, who in making some experiments, the results of which have not as yet been published, found that dry formaldehyd gas was uncertain in action.

The large type of generator which was submitted for trial in these experiments contains in its lamp, which is filled with mineral wool, 1 quart of wood alcohol, and the volatilization of this quantity and its conversion into formaldehyd is completed in about forty-five to fifty minutes. No effort has been made to determine the percentage of gas evolved in this process, as the methods for such determination are very indefinite and variable and give exceedingly discordant results.

In addition to the large type of generator the company controlling the Kuhn apparatus also presented a very much smaller type of apparatus consuming 8 ounces or 250 c. c. of wood alcohol in the course of twenty-four hours, and for which they claim efficient deodorizing and mildly germicidal powers in close and ill-smelling apartments, water closets, etc. These claims were investigated, and the results fully justified the assertions made in behalf of this small apparatus.

The following experiments were made and the results are herewith set forth. All the experiments were controlled. All cultures were exposed on slips of sterilized filter paper and these slips were placed in sterilized envelopes, which were sealed and then subjected to the tests as indicated below. After exposure the slips were planted into tubes of bouillon and these were subjected to a temperature of 37° C. for twenty-four hours.

The word "growth" signifies that a germicidal effect was not obtained, and the words "no growth" that the exposure had resulted in the death of the organism.

EXPERIMENT NO. 1.—*Alcohol, 1,000 c. c.; time, twenty-one hours.*

Shelf.—Typhoid, no growth; colon, no growth; anthrax, no growth; diphtheria, no growth.

Floor.—Anthrax, no growth; colon, no growth; diphtheria, no growth; typhoid, no growth.

Blanket, 7 layers.—Anthrax, growth; diphtheria, no growth; colon, no growth.

Blanket roll, 5 and 7 layers.—Anthrax, growth; diphtheria, no growth; typhoid, no growth.

Blanket, 5 layers.—Anthrax (2), growth; diphtheria, no growth; colon, no growth. Controls all grew.

EXPERIMENT NO. 2.—*Alcohol, 750 c. c.; time, twenty-one hours.*

Controls.—Typhoid, growth; icteroides, growth; diphtheria, growth; colon, growth; anthrax, growth.

Cultures on shelf in sealed envelopes.—Icteroides (5), no growth; diphtheria (3), no growth; colon (2), no growth; typhoid (3), no growth; anthrax (2), no growth.

Floor, cultures in sealed envelopes.—Anthrax (3), no growth; typhoid (4), no growth; diphtheria (3), no growth; colon (4), no growth; icteroides (2), no growth.

Blanket, 8 layers, cultures in sealed envelopes.—Diphtheria, no growth; icteroides, no growth; typhoid, no growth; colon, no growth.

Blanket, 4 layers.—Anthrax, growth (inhibited); icteroides, no growth; typhoid, no growth; diphtheria, no growth; colon, no growth.

Hair pillow, cultures in sealed envelopes.—Anthrax, no growth; colon

(2), no growth; diphtheria, no growth; typhoid, no growth; icteroides, no growth.

EXPERIMENT NO. 3.—*Alcohol, 1,000 c. c.; time, four and one-half hours.*

Shelf.—Anthrax, no growth; diphtheria, no growth; typhoid, no growth; colon, no growth; icteroides, no growth.

Floor.—Anthrax (2), no growth; diphtheria (2), no growth; typhoid, (2), no growth; colon, (2), no growth; icteroides (2), no growth.

Hair pillow.—Anthrax, growth; diphtheria, no growth; typhoid, no growth; colon, growth; icteroides, growth.

Blanket bag (4 layers).—Anthrax, growth; diphtheria, no growth; typhoid, no growth; colon, no growth; icteroides, no growth.

Blanket (8 layers), on shelf.—Anthrax, growth; diphtheria, no growth; typhoid, no growth; colon, growth; icteroides, growth.

EXPERIMENT NO. 4.

This experiment was made with the view of disinfecting a room or apartment as nearly as possible under the conditions which would obtain after the occurrence of a case of infectious disease as typhoid fever, diphtheria, or yellow fever. To this end cultures on slips of filter paper, as before, were placed in sealed envelopes and these envelopes were put between folds of a double blanket, hung over a line; placed in the interior of a hair pillow; under a piece of very heavy Brussels carpet; against the wall under a square of heavy ornamental wall paper; in the interior of a stiff felt hat, under the sweat band; in the interior of a lady's straw hat under similar conditions; in the interior of a soft felt hat; in the pocket of a coat, and in the pocket of a pair of trousers. One thousand cubic centimeters of alcohol were burned and the time was limited to three hours

The results are set forth as follows (alcohol 1,000 c. c., time, three hours):

Blanket.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Hair pillow.—Typhoid, no growth; icteroides, growth; diphtheria, no growth.

Stiff hat.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

White shirt (laundered).—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Heavy wall paper.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Heavy Brussels carpet.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Lady's straw hat.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

In outing shirt.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Cultures in coat pocket.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Cultures in trousers pocket.—Typhoid, no growth; icteroides, no growth; diphtheria, no growth.

Cultures in soft-felt hat.—Typhoid, no growth; diphtheria, no growth.